Faculty of Agricultural and Nutritional Science

Christian-Albrechts-University Kiel

Institute of Animal Breeding and Husbandry

Measuring the affective state in pigs: the role of immunoglobulin A

F. Warnken[1], K. Krugmann[1], I. Czycholl[1], R. Lucius[2], A. Tholey[3], J. Krieter[1]

[1] Institute of Animal Breeding and Husbandry, Christian-Albrechts-University Kiel, Germany
[2] Institute of Anatomy, Christian-Albrechts-University Kiel, Germany
[3] Institute for Experimental Medicine, Christian-Albrechts-University Kiel, Germany

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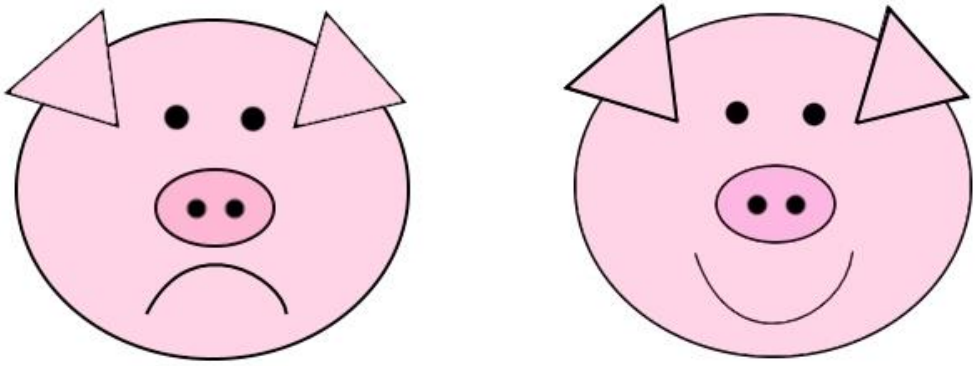
fwarnken@tierzucht.uni-kiel.de

The affective state

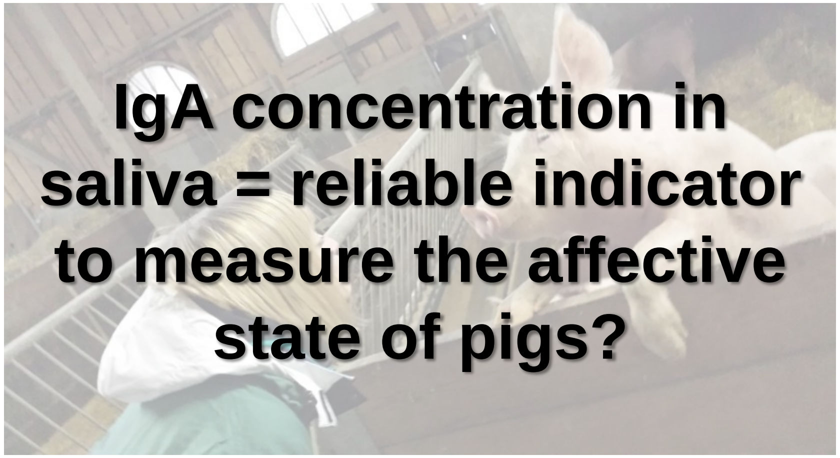
- Growing consumers´ wish: products from animal friendly housing (Roex & Miele, 2005)
- Affective state as important part of animal welfare (Vanhonacker et al., 2008)
- Low reliability and high subjectivity of existing measurement methods (Czycholl et al., 2017)

→ Need for objective indicators to measure the animals affective state (Webster, 2005)



Aim of the present study

- Immunoglobulin A (IgA) in human studies
  - Humor arousal increases IgA concentration in human saliva (McClelland & Cheriff, 1997)
  - Reduction of salivary IgA in stress conditions (Afrisham et al., 2016)
- Pigs as an often described animal model for humans
  - Similar oral maxillofacial region (Wang et al., 2007)
  - Porcine immune system resembles humans for >80% (Dawson, 2011)



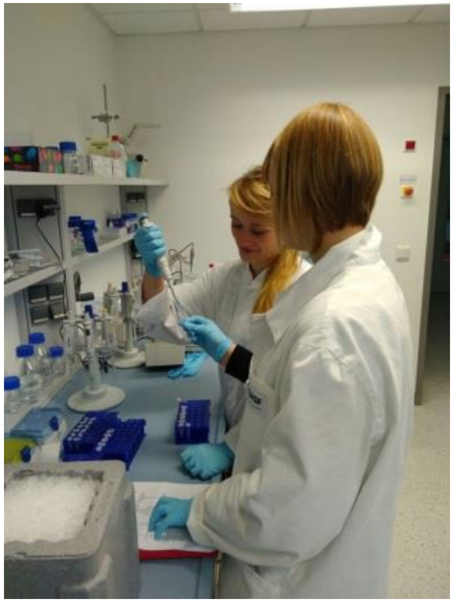
Animals & housing

- 288 cross breed ((LW x LR) x Pi) fattening pigs
  - 125 male
  - 163 female
- Three different housing systems in Northern Germany
  - Conventional system
  - Straw interspersed indoor and outdoor area
  - Straw interspersed indoor and outdoor area + rooting area
- Two batches (summer, winter)
- Undocked, castrated (males)

Saliva sampling & analysis

- End of final fattening (body weight ~ 100kg)
- Synthetic fiber role (Cortisol-Salivette®, Sarstedt AG & Co, Nümbrecht – Germany)
- Immediate freezing

- Defreezing & centrifugation (1000xg, 20°C, 2 min)
- Direct quantitative sandwich-ELISA-Kit for pig-IgA (Celltrend GmbH, Luckenwalde – Germany)



Statistical analysis

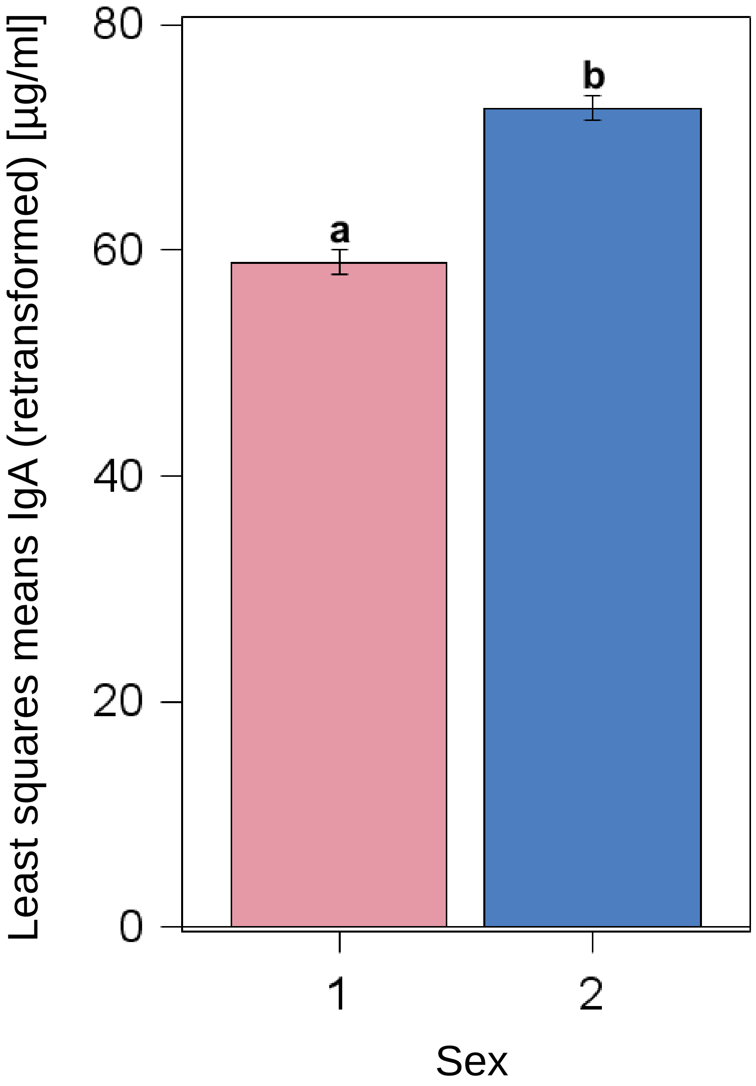
- SAS® 9.4 (SAS Institute Inc., 2017)
  - Log10-transformation for normal distribution
  - Linear mixed model (PROC MIXED)

$$y_{ijkl} = \mu + F_i + S_j + B_{ik} + e_{ijkl}$$

y_{ijkl} = l^{th} observation of the log10-IgA concentration (l = 1,…, 288)
μ = general mean
F_i = fixed effect of the i^{th} farm (i = 1, 2, 3)
S_j = fixed effect of the j^{th} sex (j = 1 (female), 2 (male))
B_{ik} = fixed effect of the k^{th} batch within the i^{th} farm (k = 1, 2)
e_{ijkl} = random residual error

  - Significance level: 5%

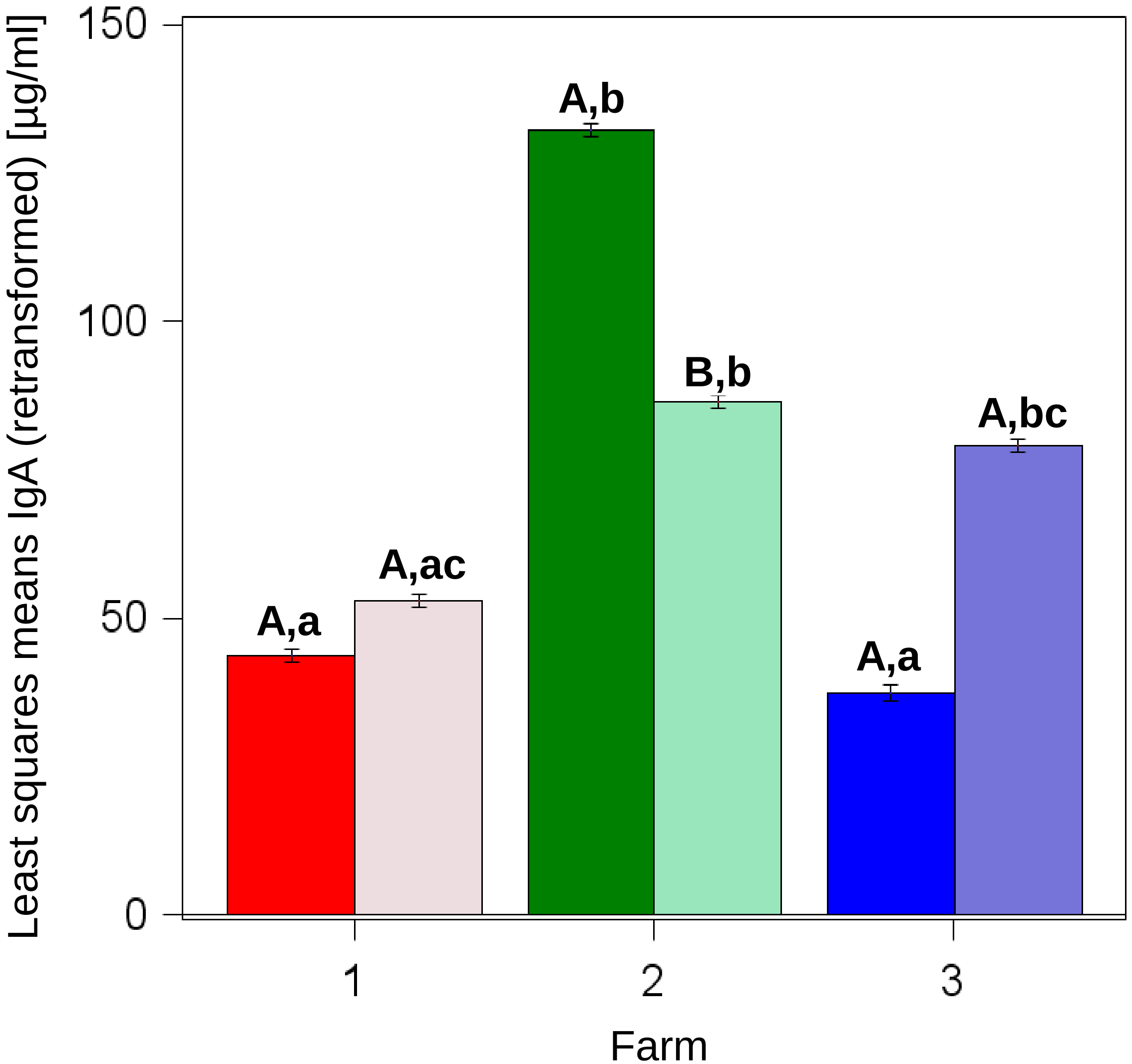
Effect of sex



Sex		LSM ± SE [µg/ml]
Female		58.9 ± 1.1
Male		72.6 ± 1.1

a, b: significant differences between the sexes

Effect of batch within the farm

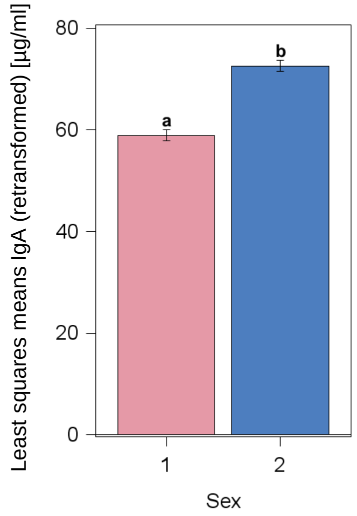


Farm	Batch		LSM±SE [µg/ml]
1	1	red	43.7 ± 1.1
	2	light pink	53.0 ± 1.1
2	1	dark green	132.2 ± 1.1
	2	light green	86.5 ± 1.1
3	1	blue	37.4 ± 1.3
	2	lavender	79.1 ± 1.2

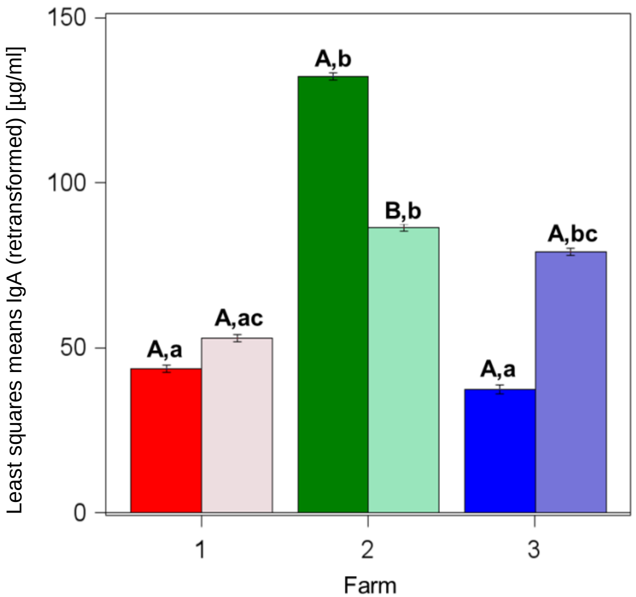
A, B: significant differences between the batches within the farm
a - c: significant differences between the farms within the batches

IgA = suitable indicator?

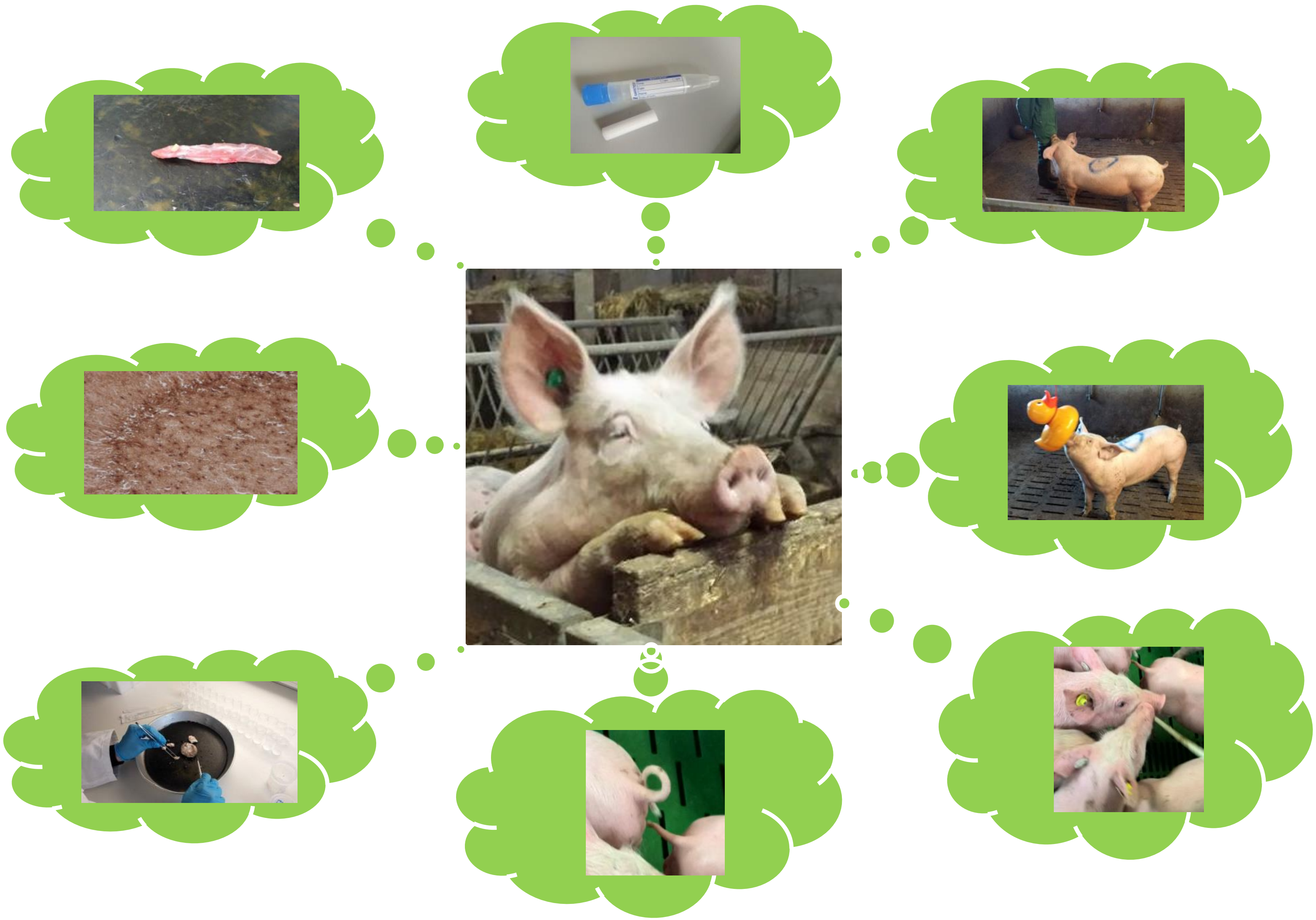
- Effect of sex
  - Influence of sex hormones (Gaillard & Spinedi, 1998)
    - → Estrogen = IgA↑, androgen = IgA↓ (Grossmann, 1984)
    - → Castration (Grossmann, 1984)



- Effect of batch within the farm
  - Different environments: barren vs. enriched
    - → Affective state (Bosch et al., 2004)
    - → Health (Kelley, 1980, Neville, 2008)
    - → Interindividual, e.g. genetics (Calder & Kew, 2002, Mangino et al., 2017)



Outlook



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H. WILHELM SCHAUMANN STIFTUNG

References

[1] Fraser, D., 2008. Understanding animal welfare. Acta Veterinaria Scandinavica.

[2] Roex, J. & Miele, M., 2005. Farm Animal Welfare Concerns: Consumers, Retailers and Producers. Cardiff University, School of City and Regional Planning, Cardiff, Wales, UK.

[3] Vanhonacker, F., Verbeke, W., Van Pouke, E., Tuyttens, Frank A.M.., 2008. Do citizens and farmers interpret the concept of farm animal welfare differently? Livestock Science 116,126-136.

[4] Czycholl, I., Beilage, E.G., Henning, C., Krieter, J., 2017. Reliability of the qualitative behavior assessment as included in the Welfare Quality Assessment protocol for growing pigs. Journal of animal science 95, 3445–3454.

[5] Webster, J., 2005. The assessment and implementation of animal welfare: theory into practice. Revue scientifique et technique (International Office of Epizootics), 723–734.

[6] McClelland, D.C. & Cheriff, A.D., 1997. The immunoenhancing effects of humor on secretory IgA and resistance to respiratory infections. Psychology & Health, 12:3, 329-344.

[7] Afrisham, R., Aberomand, M., SoliemaniFar, O., Kooti, W., Ashtary-Larky, D., Alamiri, F., Najjar-Asl, S., Khaneh-Keshi, A., Sadeh-Nejadi, S., 2016: Levels of salivary immunoglobulin A under psychological stress and its relationship with rumination and five personality traits in medical students. The European Journal of Psychiatry, vol. 30, no. 1.

[8] Wang, S., Liu, Y., Fang, D., Shi, S., 2007. The miniature pig: a useful large animal model for dental and orofacial research. Oral diseases 13: 530-537.

[9] Dawson, H., 2011. A comperative assessment of the pig, mouse, and human genomes: structural and functional analysis of genes involved in immunity and inflammation. The minipig in Biomedical research (McAnulty, P.A., ed.), CRC Press, Taylor & Francis Group, pp. 321-341.

[10] Gaillard, R.C., Spinedi, E., 1998. Sex- and stress-steroids interactions and the immune system: evidence for a neuroendocrine-immunological sexual dimorphism. Domestic Animal Endocrinology 15, 345–352.

[11] Grossmann, C.J., 1984. Regulation of the Immune System by Sex Steroids. Endocrine Reviews.

[12] Chandra, R., K., 1997. Nutrition and the immune system: an introduction. American Journal of Clinical Nutrition.

[13] Bosch, J.A., Ring, C., Amerongen, A.V.N., 2004. Academic examinations and immunity: academic stress or examination stress? Psychosomatic Medicine, 625–627.

[14] Kelley, K.W., 1980. Stress and Immune function: a bibliographic review. Annales de Recherches Vétérinaires, Inra Editions, 445–478.

[15] Neville, V., Gleeson, M., Folland, J.P., 2008. Salivary IgA as a Risk Factor for Upper Respiratory Infections in Elite Professional Athletes. Medicine & Science in Sports & Exercise 40, 1228–1236.

[16] Calder, P.C., Kew, S., 2002. The immune system: a target for functional foods? BJN 88, 165-176.

[17] Mangino, M., Roederer, M., Beddall, M.H., Nestle, F.O., Spector, T.D., 2017. Innate and adaptive immune traits are differentially affected by genetic and environmental factors. Nature communications 8, 13850.

Attachment

- Feeding conditions
  - Farm 1
    - → 16.5 % (foremast) – 15.5%(final fattening) raw protein
    - → Main protein supply: soy extraction meal
  - Farm 2
    - → 22.4% (foremast) – 15.4% (final fattening) raw protein
    - → Main protein supply: field beans, peas, potato protein
  - Farm 3
    - → 20.5% raw protein
    - → Main protein supply: field beans